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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/024,391	12/21/2001	Takayuki Watanabe	011732	5820
23850	7590	04/20/2004	EXAMINER	
ARMSTRONG, KRATZ, QUINTOS, HANSON & BROOKS, LLP 1725 K STREET, NW SUITE 1000 WASHINGTON, DC 20006			TRAN, BINH X	
			ART UNIT	PAPER NUMBER
			1765	

DATE MAILED: 04/20/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/024,391

Applicant(s)

WATANABE ET AL.

Examiner

Binh X Tran

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 December 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-40 is/are pending in the application.
- 4a) Of the above claim(s) 4 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-30, 38-39 is/are rejected.
- 7) ☒ Claim(s) 31-37 and 40 is/are objected to.
- 8) ☒ Claim(s) 1-40 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date: _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>12/17/03; 01/18/02</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of Species I (claims 1-3, 5-40) in Paper filed on 12-29-2004 is acknowledged.
2. Claim 4 is withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected species, there being no allowable generic or linking claim. Election was made **without** traverse in Paper filed on 12-29-2003.

Specification

3. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Objections

4. Claims 30-37, 40 are objected to because of the following informalities:

In line 16 and lines 16, 20, 23 and 27 of claim 30, the term "forth" appears to be a typo error for the term --fourth--. This typo error also appears many times in claims 31-37, 40. The examiner only points out one specific example of this typo error. The applicants are required to correct all typo errors in the claim.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the first paragraph of 35 U.S.C. 112:

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The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

6. Claims 15, 26 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

In claims 15, 26, the examiner does not understand the limitation "acetic acid is added into the etchant by the application material" (emphasis added). The applicants define that the application material comprises of water or hydrogen peroxide in claims 14 and/or 25. Therefore, it is impossible to add acetic acid into the solution using water or hydrogen peroxide.

7. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

8. Claim 15, 22-23, 26, 28-30 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claims 15, 26, the limitation "the hydrogen peroxide water having a density of maximum 30% of hydrochloric acid against hydrochloric acid" is indefinite. It is unclear from the claim whether the applicants would like to claim any relationship between hydrochloric acid with itself (i.e. hydrochloric acid against hydrochloric acid).

In claim 22, "the selective etching mask is selected from a group of" is indefinite for improper use of Markush language. The examiner suggest to replace the above phrase with --the selected mask is selected from the group consisting of--.

Claim 23 is indefinite because it depends on indefinite claim 22.

In step b of claims 28-29, "etching the semiconductor structure in which the semiconductor layers are grown" lacks antecedent basis. The examiner suggests replacing it with -- etching the semiconductor structure in which the first to the fourth semiconductor layers are grown--.

In step (f) of claim 30, "removing the protection pattern used as a mask in the step of (a) by etching" lack antecedent basis. Applicants do not disclose a protection pattern used as a mask in step (a). However, applicants do disclose the protection pattern used as a mask in step (b).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was

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not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

11. Claims 1-3, 5, 8, 10-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsukiji et al. (US 5,441,012) in view of Adachi ("Chemical Etching of InGaAsP/InP DH Wafer").

Respect to claim 1, Tsukiji discloses a method comprising the steps of:

growing an InP layer (7) on a surface of starting growth, resulting the InP layer having a convex structure (Fig 1a-Fig 1c);

wet etching the InP layer by an etchant thereby flattening a surface of the InP layer (Fig 1d, col. 3 lines 57-67).

Tsukiji fails to disclose that the InP layer is etched by an etchant including hydrochloric acid (HCl) and acetic acid (CH₃COOH). In an etching method, Adachi teaches to etch the InP layer with hydrochloric acid and acetic acid (Table 1, page 1054). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Tsukiji in view of Adachi by using hydrochloric and acetic acid because it exhibits clear selective etching behavior.

Respect to claim 2, Tsukiji discloses the convex structure result from the convex structure of the surface in the step of growing InP layer (Fig 1c). Respect to claim 3, Tsukiji teaches the convex structure of the starting growth is a mesa structure (col. 3 lines 45-50). Respect to claim 5, Tsukiji teaches the surface of the starting growth is a flat surface and has a selective growth mask (5) (Fig 1a-1b). Respect to claim 8, Tsukiji

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teaches the lower surface of the InP layer (7) is lower than the highest position of mesa structure (Fig 1c) and the InP layer (7) has a flat surface locating at the lowest height position after the etching step is completed (Fig 1c-Fig 1d). Respect to claims 10-11, Tsukiji discloses the selective growth mask (5) is provided at a part of the convex structure; the convex structure is formed as corresponding to an edge of the selective growth mask (5) and there is a slope area on the surface of the starting growth (Fig 1c). Respect to claim 12, Tsukiji discloses convex structure is covered with the InP layer on the surface of the starting growth.

Claim 13 differs from the cited prior arts by the density relationship between HCl and acetic acid. Adachi teaches to vary the concentration in term of molar ratio and volume percentage of the etching solution because they are result effective variables (page 1054). The density of the solution depends on the molar amount and volume percentage. Any person in the art would be able to calculate the density from molar concentration and volume percentage if the total amount of the solution is known. Therefore, the examiner interprets the Adachi implicitly teaches the density of the solution is a result effective variable. The result effective variable is commonly determined by routine experiment. The process of conducting routine experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiments to obtain optimal density of acetic acid and HCl as an expected result.

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Respect to claims 14, 16-17 Adachi teaches the etching solution comprises water and/or H_2O_2 (aka hydrogen peroxide). The limitation of claim 15 has been discussed above under Adachi's reference.

Respect to claim 18, Tsukiji discloses the step of: etching an InP layer (7) which shoulders a selective etching mask (5) and has a convex structure on the surface of the InP layer; flattening a surface of the InP layer except the area under the selective etching mask (fig 1c-1d). The limitation that an etchant includes HCl and acetic acid has been discussed above under Adachi's reference. The limitation of claim 19 has been discussed above under Tsukiji's reference. Respect to claims 20-21, Tsukiji teaches the selective etching mask (5) is provided on an upper part of the convex structure on the surface of the starting growth or on a surface of the convex structure part on the InP layer. Respect to claim 22-23, Tsukiji teaches the selective etching mask is made of silicon oxide (col.3 lines 40-45). The limitations of claims 24-27 have been discussed above.

12. Claims 6-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsukiji in view of Adachi, and further in view of Goto (US 6,037,189).

Respect to claims 6-7, Tsukiji fails to disclose the InP layer comprises at least of or closer to at least one of [100] surface, [011] surface. Goto discloses the InP layer is flat and has or closer to at least one of [100] or [011] surface. It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Tsukiji and Adachi in view of Goto by having InP layer with [100] or [011] surface because this

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plane allows us to control the thickness and the wavelength of the optical device accurately.

13. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tsukiji in view of Adachi, and further in view of Kimura (US 5,452,315).

Respect to claim 9, Tsukiji discloses the InP layer positioned at the same level with the highest position of the surface of the starting growth. Tsukiji fails to disclose the InP layer has a flat surface locating at a height corresponding to a highest position of the surface of the starting growth after the etching step. Kimura teaches the InP layer (17) has flat surface locating at a height corresponding to a highest position of the surface of the starting growth (Fig 6d). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Tsukiji and Adachi in view of Kimura, by having a flat surface locating at a height corresponding to a highest position of the surface of the starting growth because this would create an even level between the InP layer and the starting growth surface.

14. Claims 38-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kimura et al. (US 5,452,315) in view of Otsuka et al. (US6,110,756) and Adachi.

Respect to claims 38-39, Kimura discloses a method comprising the step of:
forming a selective growth mask (12) on an InP substrate (1) (Fig 8a);
forming a semiconductor pattern by selectively growing a first semiconductor layer (14) made of InP on the InP substrate (1), selectively growing a second semiconductor layer (15a) on the first semiconductor layer, and selectively growing the

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third semiconductor layer (18) made of InP on the second semiconductor layer (7) (Fig 8c, col. 17-18);

Kimura does not explicitly disclose the second semiconductor layer has a smaller band gap than the first semiconductor layer. Otsuka teaches the second semiconductor layer has a smaller band gap the first semiconductor layer (col. 17 line 50 to col. 18 line 20). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Kimura in view of Otsuka because it will reduce the leakage current.

Kimura fails to disclose that the third semiconductor made of InP is etched by an etchant including hydrochloric acid (HCl) and acetic acid (CH₃COOH). In an etching method, Adachi teaches to etch the InP layer with hydrochloric acid and acetic acid (Table 1, page 1054). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Tsukiji in view of Adachi by using hydrochloric and acetic acid because it exhibits clear selective etching behavior.

Respect to claim 39, Kimura teaches to remove the selective growth mask (12) (Fig 8d).

Allowable Subject Matter

15. Claims 28-30 would be allowable if rewritten or amended to overcome typo error and the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action.

16. Claims 31-37, 40 are objected to because of the minor typo error in the claim, but would be allowable if rewritten to correct the typo error.

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17. The following is a statement of reasons for the indication of allowable subject matter: The cited prior arts fail to disclose or suggest the step of etching the fourth semiconductor layer (or higher number semiconductor layer) by an etchant including hydrochloric acid and acetic acid in conjunction with all other limitations in the claims.

Conclusion

18. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Binh X Tran whose telephone number is (571) 272-1469. The examiner can normally be reached on Monday-Thursday and every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine G Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Binh X. Tran

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER

